

The tadpoles of *Hyla oliveirai* and *Hyla decipiens* with notes on the *Hyla microcephala* group (Anura, Hylidae)

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The previously unknown tadpole of *Hyla oliveirai* is described and illustrated based on a population from Alagoas State, northeastern Brazil. The tadpole of *Hyla decipiens* is briefly redescribed and illustrated from Rio de Janeiro State, southeastern Brazil, and compared with that of *H. oliveirai*. The latter has a single, wide brown irregular stripe on the tail, while *H. decipiens* has three or four narrower, more regular stripes. The oral disc of both species does not bear denticles and has a single row of papillae extending ventrally and laterally. *Hyla oliveirai* has just one ridge between the beak and the papillae on the lower lip, while *H. decipiens* has two ridges. The tadpoles of *H. oliveirai* and *H. decipiens* are similar to that of *H. berthaltutzae* in the general shape, colour pattern and oral disc. These characteristics, added to adult characteristics, may suggest a close relationship between these species. Comparisons between these tadpoles and other species from the *Hyla microcephala* group show remarkable differences, suggesting that *H. oliveirai*, *H. decipiens* and *H. berthaltutzae* do not belong in the *H. microcephala* group.

INTRODUCTION

The small species of *Hyla* have been arranged into groups by COCHRAN (1955), COCHRAN & GOIN (1970), DUELLMAN (1970) and LITZ (1973). All of these species that have been studied karyologically have 30 chromosomes (DUELLMAN & TRUEB, 1983). The *Hyla microcephala* group is one of these groups and includes small, yellowish-tan species. Highly variable phenetic arrangements have been proposed for this group (e.g., DUELLMAN & FOULITTLE, 1968, COCHRAN & GOIN, 1970, BASTOS & POMBAI, 1996). Much of the confusion in these different arrangements has been the result of a lack of knowledge on the osteology, tadpoles, mating calls, and biology of the included species, making it difficult to determine more sharply the relationships among these small hylid frogs.

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As recognized by POMBAL & BASTOS (1998), the *Hyla microcephala* group contains 15 species, seven of them being known from the Atlantic Forest and one from the "cerrado" (sensu AB'SABER, 1977) in Brazil (*H. berthallutzae* Bokermann, 1962, *H. branneri* Cochran, 1948; *H. decipiens* A. Lutz, 1925; *H. haddadi* Bastos & Pombal, 1996; *H. meridiana* Lutz, 1973; *H. oliveirai* Bokermann, 1963, *H. wernerii*, Cochran, 1952, and *H. cruzi* Pombal & Bastos, 1998, the latter from the "cerrado"). None of the Brazilian species, except *H. wernerii*, were traditionally recognised in the *Hyla microcephala* group (DUELLMAN & FOUQUETTE, 1968; DUELLMAN, 1970).

Hyla oliveirai and *Hyla decipiens* are very similar species with known distribution from northeastern to southeastern Brazil (FROST, 1985; BASTOS & POMBAL, 1996) The tadpole of *H. decipiens* was described, without illustrations, from Rio de Janeiro State by LUTZ (1973). Herein, we describe the tadpole of *H. oliveirai* and compare it to that of *H. decipiens*. Notes about other closely related species are added

MATERIAL AND METHODS

All specimens examined in this study are deposited in the collection of Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro (ZUF RJ) Adults and tadpoles of *H. oliveirai* (ZUF RJ 7326-7328, 7446) were collected from a population in Alagoas State (Município de Quebrangulo, 9°19'S, 36°28'W) in November 1997 Adults and tadpoles of *H. decipiens* (ZUF RJ 4441) were collected from a population in Rio de Janeiro State (Município de Itaguaí, 22°44'S, 43°42'W) in March 1991 Coordinates were taken from local maps.

Adults were anaesthetised in 0.25% chlorotone, preserved in 10% formalin, and stored in 70% alcohol Tadpoles were anaesthetised in 0.1% chlorotone and stored in 5% formalin Two males and a female of *H. oliveirai* were kept alive and put in a plastic bag where eggs were obtained. The tadpoles that emerged from these eggs were reared until stages 33-37 (GOSLER, 1960) for study. Tadpoles collected in the field were identified by means of comparisons with those obtained from eggs.

The tadpoles of *H. oliveirai* obtained from eggs and others collected in temporary ponds of an open area were raised in captivity in a plastic box (measurements 262 × 77 × 147 mm) with about 1.5 l of water and a dense layer of leaves on the bottom Eleven tadpoles were maintained in the box Fish food was regularly provided The water temperature and pH were not controlled The studied tadpoles of *H. decipiens* were not raised. However, they were compared with other specimens previously reared by SPCS from the eggs to metamorphosis.

Tadpoles reared from the eggs until stages 36-37 were used in the descriptions and measurements. No changes were observed in the oral morphology or general shape of reared tadpoles. Eventually other stages were used for comparisons and to provide a better account of colour pattern development Measurements were taken according to the methods proposed by ALFUG (1970) and DUELLMAN (1970), except interorbital distance which was taken between the inner margins of eyes. An ocular micrometer in a stereomicroscope was used for measurements, except for the total length, which was taken with a caliper Drawings were made using a stereomicroscope with a camera lucida

RESULTS

Hyla oliveirai BOKERMANN, 1963 (FIG. 1a-d)

Description. Mean total length at stage 37, 20.7 ± 0.3 mm ($n = 7$, tab. 1). Body oval in lateral view, snout rounded in dorsal view. Body width 65% (60-70%) of body length. Eyes lateral, visible ventrally; interorbital distance about twice of eye diameter. Nostrils about six times in eye diameter, rounded, directed ventrally on snout tip. Internostril distance similar to interorbital distance. Spiracle sinistral, short, slightly projecting, distance from spiracle to snout approximately 67% (60-74%) of body length. Anal tube short, dextral, attached to ventral fin. Tail length 64% (62-67%) of total length, tail musculature tapering gradually to the tip. Dorsal fin starting at final portion of body, slightly arched in lateral view; ventral fin rectilinear in lateral view. Lateral line system invisible. Oral disc anteroventral, its width approximately 23% (21-27%) of body width, with single row of rounded papillae extending ventrally and laterally, without denticles; lower lip with one dermal ridge between beak and papillae. Beak strong, finely serrated; upper jaw slightly arched and lower jaw approximately U-shaped.

Colour in 5% formalin. - Body brown in dorsal view, in lateral view with narrow cream stripe extending from snout to lower margin of eye. Body in ventral view brown with marble-like aspect in anterior region and slightly transparent in posterior region. Narrow cream stripes

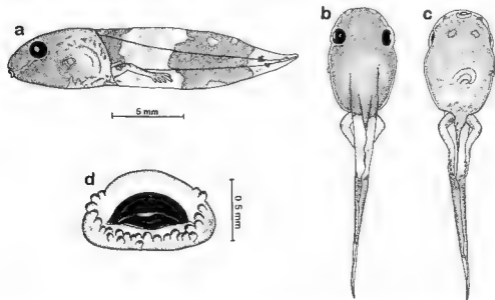


Fig. 1. *H. oliveirai* (ZUFJ 7446): Tadpole in (a) lateral, (b) dorsal and (c) ventral views, (d) oral disc.

Table 1. – Measurements ($\bar{x} \pm s$) in millimeters of tadpoles in stage 36-37.

Measurement	<i>Hyla oliveirai</i> (n = 7)	<i>Hyla decipiens</i> (n = 10)
Total length	20.7 ± 0.3	20.8 ± 0.4
Body length	7.5 ± 0.2	7.7 ± 0.1
Body width	4.9 ± 0.1	4.6 ± 0.1
Body height	4.1 ± 0.1	4.1 ± 0.1
Tail height	4.0 ± 0.1	4.5 ± 0.1
Dorsal fin	1.2 ± 0.1	1.5 ± 0.1
Ventral fin	1.2 ± 0.1	1.4 ± 0.1
Spiracle-snout distance	6.4 ± 0.2	4.5 ± 0.1
Interorbital distance	2.6 ± 0.0	2.5 ± 0.1
Internostril distance	2.5 ± 0.0	2.4 ± 0.0
Eye diameter	1.2 ± 0.0	1.3 ± 0.0
Nostril diameter	0.2 ± 0.0	0.2 ± 0.0
Mouth width	1.1 ± 0.0	1.0 ± 0.0

usually visible on both sides of oral disc, extending to lower margin of eyes in ventral view, forming an inconspicuous inverted "V". Two rounded, slight cream to yellowish-brown depressions under mouth between eyes. Tip of spiracle cream. Tail in lateral view cream to yellowish with base of dorsal fin and tail musculature brown and an irregular, transverse brown stripe in posterior half on which yellowish spots (usually one on each fin) may be present.

Colour in life. – Tadpoles in life similar to preserved ones, but with more brilliant colours. Iris coppery. Newly metamorphosed frog with a nacreous triangle on snout and two broad nacreous bands disposed laterally from posterior margins of eyes to end of body, area between bands with subrectangular, grayish-brown mark enclosing grayish-brown middle line.

HYLA DECIPENS A. LUTZ, 1925 (FIG. 2a-d)

Description. – Mean total length at stage 37, 20.8 ± 0.4 (n = 10, tab. 1). Body width corresponding to 61% (55-63%) of body length. Tail length approximately 63% (60-65%) of total length, tail musculature tapering abruptly to the tip; fins with rectilinear outline. Oral disc with approximately 21% (17-23%) of body width, with single row of slightly rounded and short papillae extending ventrally and laterally, papillae considerably attached to the lip, lower lip with two dermal ridges between beak and papillae. Otherwise as described above for *Hyla oliveirai*.

Colour in 5% formalin. – Body brown in dorsal view, in lateral view with narrow cream stripe extending from snout to lower margin of eye. Body in ventral view brown with marble-like aspect. Distinct, narrow cream stripes visible on both sides of oral disc, extending to lower

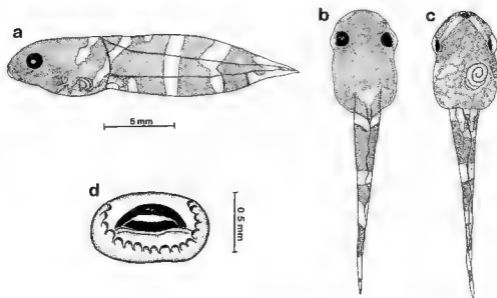


Fig. 2. *Hyla decipiens* (ZUFJRJ 4441) Tadpole in (a) lateral, (b) dorsal and (c) ventral views, (d) oral disc.

margin of eyes in ventral view, forming a conspicuous inverted "V". Tip of spiracle cream. Tail in lateral view cream to yellowish with base of dorsal fin and tail musculature brown and three or four irregular, transverse brown stripes.

DISCUSSION

The tadpoles of *Hyla oliveira* and *Hyla decipiens* have a similar colour pattern and are found in temporary ponds in open areas. Both species present a narrow cream stripe extending from the snout to the lower margin of the eye in lateral view and tail with transversal stripes, alternating brown and cream. They can be distinguished from each other by the number of transverse brown stripes in the tail: one wide stripe with a very irregular outline in *H. oliveira* and three or four narrower and more regular stripes in *H. decipiens*. The tail narrows gradually in *H. oliveira*, while it narrows abruptly in *H. decipiens*. The oral disc of both species is similar: reduced, without denticles, and with a single row of papillae extending ventrally and laterally. *Hyla oliveira* has just one dermal ridge between the beak and the papillae in the lower lip, while *H. decipiens* has two dermal ridges. The papillae in the oral disc of *H. decipiens* are less rounded, shorter and more attached to the lip than in *H. oliveira*.

The tadpoles of *H. oliveira* and *H. decipiens* are similar to that of *H. berthaultzuae* in the general shape and colour pattern. As in the former two species, the oral disc of the tadpole of

H. berthaltuae lacks denticles and has a single row of papillae extending ventrally and laterally, and two ridges are present between the beak and the papillae in the lower lip (BOKERMANN, 1963). *Hyla berthaltuae* and *H. decipiens*, as well as *H. brameri*, have very similar reproductive habits, although the latter two occur in open areas (LUTZ, 1947; BOKERMANN, 1963; BASTOS & POMBAL, 1996). They deposit the spawn on small dry sticks or leaves hanging above the ponds where the tadpoles will develop. Based on the characteristics of tadpoles, we agree with BASTOS & POMBAL (1996) about the close relationship between *H. oliveirai*, *H. decipiens* and *H. berthaltuae*. According to those authors, it would also be possible to relate *H. haddadi* to these three species based on the adult morphology.

Comparisons between tadpoles of species traditionally included in the *Hyla microcephala* group (see DUELLMAN & FOUQUETTE, 1968; DUELLMAN, 1970) with those of *H. decipiens* and *H. oliveirai* show remarkable differences. The typical tadpole of that group (based on *H. bipunctata* Spix, 1824, *H. meridiana*, *H. microcephala* Cope, 1886, *H. nana* Boulenger, 1889, *H. phlebodes* Stejneger, 1906, *H. rhodopepla* Grunther, 1859 and *H. sanborni* Schmidt, 1944 tadpoles BOKERMANN, 1963; KENNY, 1969; DUELLMAN, 1970, 1972; LAVILLA, 1990, CRUZ & DIAS, 1991) has an elongate and depressed body in lateral view (ovoid in *H. decipiens* and *H. oliveirai*), eyes almost in the middle of the body length (in the anterior third in *H. decipiens* and *H. oliveirai*), dorsal fin starting at the posterior third of the body (starting at the end of the body in *H. decipiens* and *H. oliveirai*), tail remarkably xiphocercal (just pointed in *H. decipiens* and *H. oliveirai*), and oral disc without papillae and ridges between beak and lower lip (with a single row of papillae and one or two ridges in *H. decipiens* and *H. oliveirai*).

DUELLMAN & TRUMB (1983) assumed that the small hyld frogs with 30 chromosomes form a monophyletic complex, emphasizing that the major evolutionary trends in this complex involve the larval structure, especially the mouthparts. They provided a hypothesis of the cladistic relationships among seven species groups of *Hyla* (*H. labialis* group, *H. columbiana* group, *H. minuta* group, *H. marmorata* group, *H. parviceps* group, *H. leucophyllata* group and *H. microcephala* group). The *H. microcephala* group, previously defined by DUELLMAN (1970), appeared in their study as a monophyletic group with two synapomorphies (both involving larval characteristics) body depressed and labial papillae absent. The remarkable differences (specially those involving oral structure) between the tadpoles of *H. decipiens*, *H. oliveirai* and *H. berthaltuae* and those of the other species traditionally recognized in the *H. microcephala* group suggest that the former ones do not belong to this group.

RESUMÉ

Le têtard de *Hyla oliveirai* est décrit et illustre à partir de spécimens provenant d'une population de l'état d'Alagoas, au nord du Brésil. Un têtard de *Hyla decipiens* provenant du Rio de Janeiro, au sud du Brésil, est brièvement redécrit, illustre, et sa morphologie est comparée avec celle de *H. oliveirai*. Le têtard de *H. oliveirai* a une unique bande marron large et irrégulière sur la queue, tandis que *H. decipiens* a trois ou quatre bandes plus étroites et plus régulières. Le disque oral de ces deux espèces n'a pas de denticules et a une seule rangée ventrale et latérale de papilles. Le têtard de *H. oliveirai* a un seul repli entre le bec et les papilles

sur la lèvre inférieure, tandis que *H. decipiens* en a deux. Les têtards de *H. oliveirai* et de *H. decipiens* sont semblables à ceux de *H. berthaltutzae* en ce qui concerne leur forme d'ensemble, leurs couleurs et leur disque oral. Ces caractéristiques, ajoutées à celles des adultes, suggèrent une proche parenté entre ces deux espèces. En revanche, la comparaison de ces têtards avec ceux d'autres espèces du groupe de *Hyla microcephala* montre l'existence de nettes différences, suggérant que *H. oliveirai*, *H. decipiens* et *H. berthaltutzae* n'appartiennent pas au même groupe que *H. microcephala*.

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APPENDIX 1

ADDITIONAL SPECIMENS EXAMINED

Hyla berthalutzae Bokermann, 1962 Brazil, Rio de Janeiro State, Municipality of Magé (22°39'S, 43°02'W). Adults: ZUFRJ 2283-2284, 2887, 3137, 5266, 5268-5269, 6613-6619, 6621, 6624-6625, 6628. Tadpoles: ZUFRJ 6629, 7754.

Hyla decipiens A. Lutz, 1925 Brazil, Rio de Janeiro State, Municipality of Itaguaí (22°44'S, 43°42'W). Adults: ZUFRJ 4463, 4465, 4471, 4475, 4500, 4502, 4506, 4516, 4591-4592, 4594. Tadpoles: ZUFRJ 4543.

Hyla oliveirai Bokermann, 1963. - Brazil, Bahia State, Municipality of Maracás (13°26'S, 40°25'W). Adult: MZUSP 74148

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